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(54) **CLOSURE FOR A CONTAINER, BEVERAGE CONTAINER AND A METHOD OF OPERATING A CLOSURE.**

VERSCHLUSS FÜR EINEN BEHÄLTER, GETRÄNKEBEHÄLTER UND BETRIEBSVERFAHREN
FÜR DEN VERSCHLUSS

FERMETURE POUR RÉCIPIENT, RÉCIPIENT DE BOISSON ET PROCÉDÉ DE FONCTIONNEMENT
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- **KNUTSEN, Rune**
N-4085 Hundvåg (NO)
- **NÆSJE, Kjetil**
N-4314 Sandnes (NO)

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(74) Representative: **Håmsø Patentbyrå AS**
P.O. Box 171
4301 Sandnes (NO)

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(73) Proprietor: **SmartSeal AS**
4006 Stavanger (NO)

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(72) Inventors:
• **FREDRIKSEN, Kyrre**
N-4021 Stavanger (NO)

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Description

Field of the Invention

[0001] The invention relates to a closure for a container, for example a beverage container.

Background

[0002] To allow for improved ease of use, beverage containers may comprise resealable closures that can be operated without the need to unscrew or otherwise remove a cap, thereby allowing for one-handed operation. Conventional resealable closures comprising such features may have a valve that is operable by pulling or pushing on a portion of the closure, thereby allowing liquid contained in the bottle to flow out. The valve may either remain in an open configuration after being opened, allowing for continued flow of liquid as required, or may be configured to return to a closed configuration thereby resealing the container.

[0003] Such closures are typically mass manufactured via polymer injection moulding, using multi-cavity moulds configured to form the various components that are required to operate together to form the closures. In certain types of closures, for example where an automatically resealable valve is required, it can be difficult to achieve sufficiently small manufacturing tolerances to give the resulting product a uniform functionality regardless of the specific cavity each part is moulded in.

[0004] Various technical aspects are influenced by the way in which a resealable valve is configured. The drinking experience is strongly influenced by the ease of response of the closure valve, i.e. a more easily opened valve tends to result in an improved drinking experience. The valve should therefore be easy to operate, but should ideally not remain open, as this can result in leakage of the contents. However, return of air back into the bottle after drinking is an important concern to avoid deformation of the bottle, since the valve will ideally be air tight once it re-closes. Air returning to the bottle after drinking should therefore be controlled by configuration of the valve. A bottle in accordance with the preamble of appended claim 1, having a configurable resealable valve that aims to address these issues is disclosed in published patent application US 2009/0212061. Configuring the closure such that a lower force tends to return the valve to its closed position allows for control over the timing of this venting function.

[0005] A competing requirement, however, is that the membrane should also be resistant to damage by biting or chewing, given that the valve will tend to be operated by mouth action alone. Since users may be children, a particularly important requirement is that any small components in the closure that may represent a choking hazard are not at risk of being separated during normal use. Typical requirements involve a resistance to loosening or breaking when a force of up to 60 N is applied. Fur-

thermore, any detached part should not be so small that it could become lodged in the throat of the user. The British Soft Drinks Association has developed standards based on such requirements.

[0006] The aforementioned publication US 2009/0212061 discloses a pressure activated closure device for a beverage container, in which a pressure-sealing membrane is connected between an outer portion of the closure device and a centrally located drinking orifice portion. Movement of the drinking orifice portion results in flexure of the membrane and opening of a valve, allowing the liquid contents of the bottle to flow through the drinking orifice. The elasticity of the membrane ensures that the valve returns to its pressure-sealing position when an under-pressure supplied during drinking ceases. The deformable area of the membrane element must, due to its ring-formed shape, be either very thin or have a long extent in order to provide a sufficiently high flexibility for the membrane to be practically useful. This is an inherent weakness of the type of design in which membrane flexure occurs as a result of an extensive geometrical deformation in an area that by necessity is restricted to a small diametrical extent, i.e. the width of a bottle opening. Furthermore, in one embodiment the membrane is in its periphery only loosely connected to the remaining structure of the closure by means of a snap lock. This connection method provides the membrane with an increased freedom of movement in its outer portion, but this makes it difficult to design a sufficiently strong closure so that the above mentioned regulatory requirement for tensile strength is satisfied. To address this it may be necessary to use several types of plastic materials for the membrane, for example by using a stiffer material for the snap lock zone in relation to the deformation zone. This would result in a technically more complicated solution and as a result lead to the need to use a more expensive manufacturing process.

[0007] Patent application document WO 2004/039690 discloses an underpressure-activated valve for a drinking container. Patent application document US 2003/029890 discloses a deformable dispensing valve comprising a valve member which is toggled between a closed position and an open position. Patent application document US 2005/173368 discloses a closure device comprising a cap moulded in the closed position and providing tamper-evident means. It is an object of the invention to address one or more of the above mentioned problems.

Summary of the invention

[0008] In accordance with a first aspect of the invention there is provided a closure for a container, according to claim 1, comprising:

- an actuatable portion, said actuatable portion comprising an axially actuatable inner portion, said inner portion is provided with a lower edge, and said inner portion having a sealing member for restricting a fluid

flow through a centre of the closure with the inner portion in a first position,

wherein the actuatable portion further comprises:

- an outer portion connectable to an opening of the container, said outer portion is provided with an upper edge;
- an annular membrane connecting the upper edge of the outer portion and the lower edge of the inner portion, and
- a structurally weakened annular region provided on one of: the annular membrane on or adjacent to the upper edge of the outer portion, on or adjacent to the lower edge of the inner portion,

the closure allowing fluid flow through the centre of the closure with the inner portion in a second position axially displaced relative to the outer portion and where the second position is closer to the container; and
the closure is configured to provide a returning force to resiliently bias the inner portion towards the first position such that the returning force is lower with the inner portion located at the second position relative to the first position.

[0009] Preferably, the annular membrane is configured such that the returning force is a maximum with the inner portion located either between the first and second positions or at the first position.

[0010] A closure according to the invention allows for an improvement in the responsiveness to pressure differences across the membrane during a drinking action, while at the same time providing the means to increase the thickness of the membrane element without affecting its deflection properties and/or its sensitivity, and thereby maintaining a high tolerance to mechanical stress during use, such as biting, puncturing or tear-off.

[0011] The structurally weakened annular region may be provided by a reduction in thickness relative to an adjacent portion of the membrane. Alternatively, or additionally, the structurally weakened region may be provided by a portion of membrane material having a relatively increased flexibility, such as by use of a material having a relatively lower stiffness.

[0012] The annular membrane may be formed of the same or a different material as that for the inner and outer portions. In the case of a different material, the annular membrane material may have a lower stiffness than the inner and outer portion material.

[0013] The weakened annular region may have a radial width of between 0.1 and 10 mm, optionally between 0.1 and 1 mm or between 0.1 and 0.5 mm.

[0014] An advantage of the structurally weakened annular region is that adjustments can be made to the geometric elements in a mould tool, for example by changing the height, shape and/or extent of trimming of an individual forming cavity. This makes the design process significantly faster and less costly to set up to an adjusted and optimized production equipment. In addition, more

uniform tolerances can be achieved when using multiple cavity moulds.

[0015] Furthermore, the membrane can be designed to provide a sufficiently low force when the valve is open to allow time for air to flow back through the closure before the valve reseals, while maintaining a sufficiently high closure force when the valve remains closed.

[0016] The closure may further comprise a protective cover removably connected to a body portion comprising the outer portion of the closure. The protective cover may be connected to the body portion by a hinge portion. One or more frangible connections may be provided connecting the protective cover to the body portion. The body portion may comprise a threaded region configured for affixing the closure to a beverage container.

[0017] In accordance with the invention, there may be provided a beverage container comprising a closure according to the first aspect of the invention. The container may be a bottle, or alternatively another type of container suitable for holding a liquid, such as a pouch or a laminated pack. The beverage container may contain a liquid beverage, such as a fruit-flavoured drink.

[0018] The structurally weakened annular region may be configured such that the returning force provided by the annular membrane is lower with the inner portion in the second position relative to the first position, and is preferably a maximum with the inner portion located either between the first and second positions or at the first position.

[0019] In accordance with a second aspect of the invention there is provided a method of operating a closure for a according to appended claim 9, comprising:

providing a beverage container having a closure as described above;

actuating the inner portion relative to the outer portion to thereby open a valve comprising the sealing member and allow passage of fluid from within the beverage container through an outflow orifice, past the sealing member and out of the closure through a drinking opening.

[0020] The inner portion may be maintained displaced relative to the outer portion by a differential suction pressure across the membrane. When the differential suction pressure is removed, the inner portion preferably returns to the first position due to the returning force provided by the membrane to reseal the closure.

Detailed Description

[0021] Aspects and embodiments of the invention are described in further detail below by way of example and with reference to the enclosed drawings in which:

figure 1 is an isometric view of a closure according to an aspect of the invention;

figure 2 is a side elevation view of the closure;

figure 3 is an alternative isometric view of the closure;

figure 4 is an alternative side elevation view of the closure;

figure 5 is a side elevation view of the closure with a protective cover in an opened position;

figure 6 is a detailed view of a cover removal indicator;

figure 7 is a longitudinal section through the closure;

figure 8 is a longitudinal section through a portion of the closure comprising a membrane;

figures 9 and 10 are simplified sectional views across a membrane portion of an exemplary closure which is not part of the claimed invention, in closed and open positions respectively;

figures 11 and 12 are simplified sectional views across a membrane portion of an alternative exemplary closure in closed and open positions respectively

figures 13 and 14 are simplified sectional views across a membrane portion of an alternative exemplary closure in closed and open positions respectively;

figures 15 and 16 are simplified sectional views across a membrane portion of an alternative exemplary closure in closed and open positions respectively;

figures 17 and 18 are simplified sectional views across a membrane portion of an alternative exemplary closure in closed and open positions respectively;

figures 19 and 20 are simplified sectional views across a membrane portion of an alternative exemplary closure in closed and open positions respectively;

figure 21 is a graphical representation of membrane deflection force as a function of actuation distance for closures having two different exemplary membranes; and

figure 22 and 23 are longitudinal sections through a closure device according to US 2009/0212061 in a closed and open configuration respectively.

[0022] Figures 1 to 4 are external views of an exem-

plary closure device 100 according to an aspect of the invention, with figures 1 and 3 showing different isometric views of the closure device 100, figures 2 and 4 showing alternative side elevation views of the device 100, and figure 5 the closure device 100 with a protective cover 102 fully opened. The closure device 100 comprises a closure body portion 101 and a protective cover 102. The protective cover 102 is connected to the closure body portion 101 by a hinge portion 103 and a pair of cover removal indicators 104. The protective cover 102 may be opened by applying an upwards directed force using a finger placed against a finger grip zone marking 105 and an upper finger grip 106, which breaks the cover removal indicators 104 and exposes an inner portion 107 having a drinking opening 108, the inner portion 107 connected to an outer portion 109 of the closure 100 by a membrane 110.

[0023] An outer circumferential surface of the body portion 101 of the closure 100 comprises a series of ribs 111 that serve to enhance grip during capping and removal of the closure from a container such as a bottle. Upon removal of the closure 100 from a container (not shown), a tamper evidence ring 112 will remain on the beverage container. As illustrated in figure 3, the hinge portion 103 comprises protruding portion 113 extending from the outer circumferential edge of the closure body portion 101 and configured to engage with a corresponding depression 114 in the protective cover 102 on opening the cover 102 by flexing the hinge portion 103. On opening, thinned sections 115 of the hinge 103 are stretched and bent about their upper hinge zones 116 and lower hinge zones 117. A recess 118 on the same side of the cover 102 as the hinge portion 113 allows the protective cover 102 to fully open without interference with the body portion 101 with the hinge portion 103 fully deflected, as shown in figure 5.

[0024] Figure 5 illustrates the closure 100 as viewed from the side and in a fully opened condition. The cover removal indicators 104 are broken and the cover 102 is rotated nearly 180 degrees about the hinge portion 103 relative to the body portion 101 of the closure 100. In this configuration the protruding portion 113 is engaged with the depression 114 and the thinned sections 115 are stretched and bent on their upper hinge portions 116 and lower hinge portions 117. As described above, the recess 118 on the cover 102 allows for a larger hinge deflection.

[0025] Figure 6 illustrates in detail the components that form the cover removal indicator mechanism 104 for providing a tamper evidence function on the closure 100. The indicator mechanism 104 consists of a frangible connecting portion 601 in the form of an indicator string connected at a first end 602 to the closure body portion 101 and at a second opposing end 603 to the cover 102. During the initial opening of the cover 102, the indicator string 601 breaks somewhere between its first and second ends 602, 603, so that opening of the cover 102 is unambiguously indicated.

[0026] Figure 7 illustrates a longitudinal section

through the closure device 100 described above. A valve 701 is formed by a sealing member 704 sealing against an outflow orifice 702 of an inner wall 703 of the body portion 101 of the closure 100, the sealing member 704 extending through the outlet orifice 702 in the body portion 101. The sealing member 704 is connected to, and forms part of, the inner portion 107 of the closure 100. As indicated in figure 7, the inner portion 107 comprises longitudinal ribs 706 connecting to the sealing member 704, with fluid flow paths 707 provided between adjacent ribs 706. Actuation of the inner portion 107 in an axial direction, indicated by arrow 705, causes the membrane 110 connecting the inner portion 107 to the outer portion 109 to flex (as indicated schematically in subsequent figures), causing the sealing member 704 to disengage from the inner wall 703 and thereby allow fluid to flow through the closure 100 through the outlet orifice 702 and drinking opening 108. Elasticity of the membrane 110 provides a biasing force that, on releasing of an actuation force in the inner portion 107, tends to return the inner portion 107 to the closed position indicated in figure 7, resealing the sealing member 704 against the inner wall 703 and closing the outlet orifice 702.

[0027] Figure 7 also illustrates part of a threaded region 708 for affixing the closure 100 to a beverage container. The tamper evidence ring 112 is provided with several weakened zones 709 that are configured to break when an inner ridge 710 acts to retain the ring 112 on the beverage container by engaging with a complementary slot in the container (not shown). Upon unscrewing the closure 100 from the container, the weakened sections 709 will break and the indicator ring 112 will remain on the beverage container.

[0028] Figure 8 illustrates a longitudinal section of an actuatable portion 800 of the closure 100 as described above, the actuatable portion 800 comprising the inner portion 107 with sealing member 704, the outer portion 109 and the connecting membrane 110. The drinking opening 108 extends through the centre of the inner portion 107. The membrane 110 extends radially between a lower edge 801 of the inner portion 107 and an upper edge 802 of the outer portion 109, the outer portion 109 forming a circumferential wall 803 of the body portion 101 of the closure 100.

[0029] In the embodiment illustrated in figure 8, the membrane 110 comprises a weakened annular region 804 adjacent the upper edge 802 of the outer portion 109, the weakened annular region 804 being provided by a reduction in thickness of the membrane 110 relative to the immediately adjacent wall 803 and the adjacent portion of the membrane 110.

[0030] In the embodiment illustrated in figure 8, the wall 803 forming the outer portion 109 comprises a fastening foot 805 at a lower end 806 of the outer portion 109, the foot 805 serving to permanently connect the wall to the rest of the body portion 101 of the closure 100.

[0031] Figure 9 illustrates a partial sectional view of an actuatable portion 900 having a membrane 910 different

from the one of the present invention, without a weakened wall section, in which the membrane 910 comprises a substantially uniform thickness between the outer portion 109 and the inner portion 107. On actuation of the inner portion 107 relative to the outer portion 109, the membrane 110 flexes into the configuration indicated in figure 10. Because the membrane 910 is not provided with a thinned or weakened annular region, flexure of the membrane is substantially stiffened, and the resulting flexed form is in a characteristic S-shape. This results firstly in a substantially increased actuation force required to displace the inner portion 107, resulting in a poorer drinking experience.

[0032] Figure 11 illustrates a partial sectional view of an actuatable portion 800 of a closure 100 in a form similar to that shown in figure 8, in which the membrane 110 is provided with annular structurally weakened zone 804 in region of the membrane adjacent to the upper edge 802 of the outer portion 109. Figure 12 illustrates the actuatable portion 800 with the inner portion 107 axially displaced relative to the outer portion 109, resulting in flexing of the connecting membrane 110. In comparison with the membrane 910 of figures 9 and 10, the membrane 110 is substantially more flexible as a result of the structurally weakened zone 804, resulting in a different flexed form. The actuating force required for maintaining the inner portion 107 in the actuated position is thereby reduced due to the reduced stiffness of the membrane 110, without substantially compromising the integrity of the closure.

[0033] A differential suction pressure during drinking that applies across the membrane 110 in the actuated position shown in figure 12 would, without the structurally weakened zone 804, need to be higher to maintain the membrane in the flexed configuration in order to keep the valve open. Using the structurally weakened zone, however, the suction pressure required to maintain the valve open is reduced, while still retaining a high closing force with the actuatable portion 800 in the closed position (figure 11). Figure 13 illustrates a partial sectional view of an alternative embodiment of an actuatable portion 1300 of a closure 100, in which the membrane element 1310 is provided with a second structurally weakened annular region 1304b in addition to a first structurally weakened annular region 1304a, the first weakened annular region 1304a being similar to that described above in relation to figures 11 and 12. In this embodiment the second weakened annular region 1304b is provided on the membrane 1310 adjacent the lower edge 801 of the inner portion 107, and is in the form of a reduction in thickness relative to an adjacent portion of the membrane 1310. A force applied to the inner portion 107 to actuate the valve will apply a higher bending stress at both weakened annular regions 1304a, 1304b, causing the membrane to flex in a different way, illustrated in figure 14 with the inner portion 107 in the actuated position. As can be seen in this figure, deformation of the membrane is now largely confined to the weakened regions 1304a, 1304b.

A differential suction pressure required to maintain the valve open is thereby further reduced while maintaining a returning force on the inner portion 107 in the closed position.

[0034] Figure 15 illustrates a partial sectional view of a further alternative embodiment of an actuatable portion 1500 of a closure 100, in which a structurally weakened annular region 1504 is provided on the upper edge 802 of the outer portion 109. The effect of this, as can be seen in figure 16 illustrating the actuatable portion 1500 with the inner portion 107 in the opened position, is similar to that of providing the weakened annular region in the membrane adjacent the upper edge 802 of the outer portion. In this embodiment, the deformation in the membrane is now concentrated in the outer edge, which can allow the valve opening to be increased due to less deformation of the membrane 1510.

[0035] Figure 17 illustrates a partial sectional view of a further alternative embodiment of an actuatable portion 1700 of a closure 100, in which a structurally weakened annular region 1704 is provided on the lower edge 801 of the inner portion 107 adjacent to the membrane 1710. The effect of this, as can be seen in figure 18 illustrating the actuatable portion 1700 with the inner portion 107 in the opened position, is to provide a reduction in the applied force required to actuate the valve between that of the unmodified version (figures 9 and 10) and the version with a structurally weakened annular region along the outer edge of the membrane (figures 11 and 12).

[0036] Figure 19 illustrates a partial sectional view of a further alternative embodiment of an actuatable portion 1900 of a closure 100, in which a structurally weakened annular regions 1904a, 1904b are provided on both the lower edge 801 of the inner portion 107 and the upper edge 802 of the outer portion 109, in this case the weakened annular regions 1904a, 1904b being defined by a difference in internal and external radii at the edges where the membrane 1910 joins the inner and outer portions 107, 109, in each case the internal radius being smaller than the external radius. If this difference is sufficiently large then the resulting structurally weakened zones can provide a significant contribution to the reduction in force required to maintain the valve open and an increase in the possible valve displacement. Figure 20 illustrates the actuatable portion 1900 of figure 19 with the inner portion 107 in the axially displaced position, with the membrane 1910 fully flexed. The shape of the flexed membrane in this embodiment is similar to that of the embodiment described above in relation to figures 13 and 14. Deformation in the membrane 1910 is concentrated at the peripheral edges in the structurally weakened regions 1904a, 1904b and the valve displacement is increased due to less deformation of the membrane being required.

[0037] Figure 21 illustrates in graphical form a series of measurements of the deflection forces necessary to mechanically actuate (i.e. open) two exemplary closure embodiments, having a membrane without (curve A) and

with (curve B) an annular structurally weakened region according to an aspect of the invention. Curve B represents the force required to actuate the valve as a function of displacement for an actuatable portion of the form illustrated in figures 11 and 12, whereas curve A represents the force required for an actuatable portion of the form illustrated in figures 9 and 10. As can be seen, the force necessary to move the valve differs dramatically, even when only one structurally weakened annular region is incorporated. In each case, the force required to actuate the valve, which largely corresponds to the returning force provided by the membrane, reaches a maximum 211, 212 between a first closed position at a lower (but non-zero) displacement and a second open position at a maximum displacement. The maximum displacement may be limited by an end stop, such as when the inner portion 107 contacts the inner wall 703 of the body portion 101 (figure 7), resulting in the returning force provided by the membrane being a maximum with the inner portion 107 located between the first (closed) and second (open) positions. The closure may be configured such that the maximum returning force is applied when the valve is in the closed position, so as to maximise the sealing force. An advantage of the form of force-displacement profile illustrated in figure 21 is that the force required to retain the valve in the open position can be reduced compared to that required to open the valve. Given the viscoelastic nature of the polymeric materials that may be used for the actuatable portion of the closure, the reduction in returning force at maximum displacement allows time for air to return through the closure prior to the inner portion returning to the closed position after a differential suction pressure across the membrane is removed. By appropriate design of the membrane, a sufficiently low return force can be designed to allow enough time for air to return while maintaining a sufficiently high return force with the valve in the closed position, thereby keeping the closed valve sealed. The closure may even be configured such that the valve is stable in both the open and closed positions, although this is less preferable due to the possibility of leakage as the valve remains open after drinking.

[0038] Figure 22 illustrates a longitudinal section through a closure constructed according to previously published patent application US 2009/0212061. In this closure, a thinned and flexible area 44 is connected by a relatively rigid membrane 42 which, at its middle section, is connected to an inner portion 38 having a drinking opening 32. The thinned region 44 is connected to an annular flange portion designed with a snap fitting connecting it to the rest of the construction.

[0039] Figure 23 illustrates a longitudinal section through the closure of figure 22, but in an opened configuration. The thinned and flexible area 44 is now deformed and has changed its shape. The rest of the membrane 42 has, however, due to its rigidity, not been deformed. As described above, when large deformations need to take place across a small annular area, this leads

to a high resistance to deformation. The forces required to move the membrane is in this case are non-linear and tend to increase exponentially as the axial movement of the inner portion 38 increases. This results in difficult requirements for the material making up the closure. To achieve sufficient movement in the deformation zone 44, the material must be relatively soft, but at the same time should be stiff enough to transfer forces from the remaining membrane 42 without severe deformations. One solution is to let the difference between the material thickness of the rigid membrane 42 and the flexible area 44 be as large as possible. In that case, however, the ability to uniformly mould the closure will be affected and the product is more likely to fail in mass production.

[0040] A further difference of the closure according to the invention compared with that disclosed in US 2009/0212061 is that the lower edge 801 of the inner portion 107 of the closure (see, for example, figures 11 and 12) displaces past the upper edge 802 of the outer portion 109 when actuating the inner portion from the first (closed) position to the second (open) position. This feature is associated with the different flexed shape of the membrane connecting the inner and outer portions, which allows for a lower returning force with the inner portion in the displaced second position.

[0041] Other embodiments are intentionally within the scope of the invention, which is defined by the appended claims.

Claims

1. A closure (100) for a container, comprising:

- an actuatable portion (800, 900, 1300, 1500, 1700, 1900), said actuatable portion comprising an axially actuatable inner portion (107), said inner portion (107) is provided with a lower edge (801), and said inner portion (107) having a sealing member (704) for restricting a fluid flow through a centre of the closure (100) with the inner portion (107) in a first position, wherein the actuatable portion (800, 900, 1300, 1500, 1700, 1900) further comprises:

- an outer portion (109) connectable to an opening of the container, said outer portion (109) is provided with an upper edge (802);
- an annular membrane (110, 1310, 1510, 1710, 1910) connecting the upper edge (802) of the outer portion (109) and the lower edge (801) of the inner portion (107), the closure (100) allowing fluid flow through the centre of the closure (100) with the inner portion (107) in a second position axially displaced relative to the outer portion (109) and where the second position is closer to the container; **characterised in that**

the actuatable portion comprises a structurally weakened annular region (804, 1304a, 1304b, 1504a, 1704, 1904a, 1904b) provided on the annular membrane (110, 1310, 1510, 1710, 1910) on or adjacent to the upper edge (802) of the outer portion (109), or on or adjacent to the lower edge (801) of the inner portion (107), such that the closure (100) is configured to provide a returning force to resiliently bias the inner portion (107) towards the first position such that the returning force is lower with the inner portion (107) located at the second position relative to the first position.

2. The closure (100) of claim 1 wherein the structurally weakened annular region (804, 1304a, 1304b, 1504a, 1704, 1904a, 1904b) is provided by a reduction in thickness relative to an adjacent portion of the membrane (110, 1310, 1510, 1710, 1910), and of the inner portion (107) or the outer portion (109).
3. The closure (100) of claim 1 wherein the structurally weakened annular region (804, 1304a, 1304b, 1504a, 1704, 1904a, 1904b) is provided by a material having a lower stiffness relative to that of the membrane (110), and of the inner portion (107) or the outer portion (109).
4. The closure (100) of any preceding claim comprising a protective cover (102) removably connected to a body portion (101) comprising the outer portion (109) of the closure (100).
5. The closure (100) of claim 4 wherein the protective cover (102) is connected to the body portion (101) by a hinge portion (113) and/or one or more frangible connections (104) connecting the protective cover (102) to the body portion (101).
6. The closure (100) of claim 4 or 5 wherein the body portion (101) comprises a threaded region (708) configured for affixing the closure (100) to a beverage container.
7. A beverage container comprising a closure (100) according to any preceding claim, optionally containing a beverage.
8. The beverage container of claim 7 wherein the container is a bottle.
9. A method of operating a closure for a container comprising:
 - providing a beverage container having a closure according to any one of claims 1 to 6;
 - actuating the inner portion (107) relative to the outer portion (109) to thereby open a valve com-

prising the sealing member (704) and allow passage of fluid from within the beverage container through an outflow orifice (702), past the sealing member (704) and out of the closure (100) through a drinking opening (108).

10. The method of claim 9 wherein the inner portion (107) is maintained displaced relative to the outer portion (109) by a differential suction pressure across the membrane (110, 1310, 1510, 1710, 1910).

11. The method of claim 10 wherein, when the differential suction pressure is removed, the inner portion (107) returns to the first position due to the returning force provided by the membrane (110, 1310, 1510, 1710, 1910).

Patentansprüche

1. Verschluss (100) für einen Behälter, umfassend:

- einen betätigbaren Abschnitt (800, 900, 1300, 1500, 1700, 1900), wobei der besagte betätigbare Abschnitt einen axial betätigbaren inneren Abschnitt (107) umfasst, wobei der besagte innere Abschnitt (107) mit einer unteren Kante (801) versehen ist, und wobei der besagte innere Abschnitt (107) ein Dichtungselement (704) zum Begrenzen des Fluidflusses durch ein Zentrum des Verschlusses (100) mit dem inneren Abschnitt (107) in einer ersten Position hat, wobei der betätigbare Abschnitt (800, 900, 1300, 1500, 1700, 1900) weiter umfasst:

- einen äusseren Abschnitt (109), welcher mit einer Öffnung des Behälters verbindbar ist, wobei der besagte äussere Abschnitt (109) mit einer oberen Kante (802) versehen ist;

- eine ringförmige Membran (110, 1310, 1510, 1710, 1910), welche die obere Kante (802) des äusseren Abschnittes (109) mit der unteren Kante (801) des inneren Abschnittes (107) verbindet, wobei der Verschluss (100) einen Fluidfluss durch das Zentrum des Verschlusses (100) mit dem inneren Abschnitt (107) in einer bezüglich dem äusseren Abschnitt (109) axial verschobenen zweiten Position erlaubt, und wobei die zweite Position näher am Behälter ist;

dadurch gekennzeichnet, dass der betätigbare Abschnitt eine strukturell geschwächte ringförmige Region (804, 1304a, 1304b, 1504a, 1704, 1904a, 1904b) umfasst, welche auf der ringförmigen Membran (110, 1310, 1510, 1710,

1910) auf oder neben der oberen Kante (802) des äusseren Abschnittes (109) oder auf oder neben der unteren Kante (801) des inneren Abschnittes (107) vorgesehen ist, so dass der Verschluss (100) dazu ausgebildet ist, eine Rückstellkraft bereitzustellen, um den inneren Abschnitt (107) in Richtung der ersten Position elastisch vorzuspannen, so dass die Rückstellkraft mit dem sich in der zweiten Position befindlichen inneren Abschnitt (107) bezüglich der ersten Position niedriger ist.

2. Verschluss (100) gemäss Anspruch 1, wobei die strukturell geschwächte ringförmige Region (804, 1304a, 1304b, 1504a, 1704, 1904a, 1904b) durch eine Reduktion der Dicke bezüglich eines benachbarten Abschnittes der Membran (110, 1310, 1510, 1710, 1910) und des inneren Abschnittes (107) oder des äusseren Abschnittes (109) bereitgestellt wird.

3. Verschluss (100) gemäss Anspruch 1, wobei die strukturell geschwächte ringförmige Region (804, 1304a, 1304b, 1504a, 1704, 1904a, 1904b) durch ein Material mit, bezüglich derjenigen der Membran (110) und des inneren Abschnittes (107) oder des äusseren Abschnittes (109), tieferer Steifigkeit bereitgestellt wird.

4. Verschluss (100) gemäss einem der vorhergehenden Ansprüche, umfassend eine Schutzabdeckung (102), welche mit einem Körperabschnitt (101) umfassend den äusseren Abschnitt (109) des Verschlusses (100) lösbar verbunden ist.

5. Verschluss (100) gemäss Anspruch 4, wobei die Schutzabdeckung (101) mit dem Körperabschnitt (101) durch einen Scharnierabschnitt (113) und/oder eine oder mehrere zerbrechliche Verbindungen (104), welche die Schutzabdeckung (102) mit dem Körperabschnitt (101) verbinden, verbunden ist.

6. Verschluss (100) gemäss Anspruch 4 oder 5, wobei der Körperabschnitt (101) einen Gewindeabschnitt (708) umfasst, welcher dazu ausgebildet ist, den Verschluss (100) an einem Getränkebehälter zu befestigen.

7. Getränkebehälter umfassend einen Verschluss (100) gemäss einem der vorhergehenden Ansprüche, optional enthaltend ein Getränk.

8. Getränkehalter gemäss Anspruch 7, wobei der Behälter eine Flasche ist.

9. Verfahren zum Betreiben eines Verschlusses für einen Behälter umfassend:

- Bereitstellen eines Getränkebehälters mit ei-

nem Verschluss gemäss einem der Ansprüche 1 bis 6;

- Betätigen des inneren Abschnittes (107) bezüglich des äusseren Abschnittes (109), um dadurch ein Ventil umfassend das Dichtungselement (704) zu öffnen und einen Durchgang des Fluides von innerhalb des Getränkebehälters durch eine Ausflussöffnung (702) an dem Dichtungselement (704) vorbei und durch eine Trinköffnung (108) aus dem Verschluss (100) heraus zu gestatten.

10. Verfahren gemäss Anspruch 9, wobei der innere Abschnitt (107) bezüglich dem äusseren Abschnitt (109) durch einen Differenzsaugdruck über der Membran (110, 1310, 1510, 1710, 1910) versetzt gehalten wird.

11. Verfahren gemäss Anspruch 10, wobei, wenn der Differenzsaugdruck entfernt wird, der innere Abschnitt (107) aufgrund der durch die Membran (110, 1310, 1510, 1710, 1910) bereitgestellten Rückstellkraft in die erste Position zurückkehrt.

Revendications

1. Une fermeture (100) pour un récipient, comprenant :

- une partie pouvant être actionnée (800, 900, 1300, 1500, 1700, 1900), ladite partie pouvant être actionnée comprenant une partie intérieure pouvant être actionnée axialement (107), ladite partie intérieure (107) étant munie d'un bord inférieur (801), ladite partie intérieure (107) ayant un élément d'étanchéité (704) destiné à limiter l'écoulement de fluide à travers un centre de la fermeture (100) avec la partie intérieure (107) dans une première position, dans laquelle la partie pouvant être actionnée (800, 900, 1300, 1500, 1700, 1900) comprend en outre :

- une partie extérieure (109) pouvant être reliée à une ouverture du récipient; la dite partie extérieure (109) étant munie d'un bord inférieur (802) ;

- une membrane annulaire (110, 1310, 1510, 1710, 1910) reliant le bord supérieur (802) de la partie extérieure (109) et le bord inférieur de la partie intérieure (107),

- la fermeture (100) permettant l'écoulement de fluide à travers un centre de la fermeture (100) avec la partie intérieure (107) dans une seconde position déplacée axialement par rapport à la partie extérieure (109) et où la seconde position est plus proche au récipient, **caractérisé en ce que** partie pouvant être actionnée comprend

une région annulaire structurellement affaiblie (804, 1304a, 1304b, 1504a, 1704, 1904a, 1904b) prévue sur la membrane annulaire (110, 1310, 1510, 1710, 1910) sur ou adjacent au bord supérieur (802) de la partie extérieure (109), où sur ou adjacent au bord inférieur (801) de la partie intérieure (107), de sorte que la fermeture est conçue pour fournir une force de retour afin de solliciter élastiquement la partie intérieure (107) vers la première position de sorte que la force de rappel est inférieure, avec la partie intérieure (107) située dans une seconde position par rapport à la première position.

2. La fermeture (100) de la revendication 1, dans laquelle la région annulaire structurellement affaiblie (804, 1304a, 1304b, 1504a, 1704, 1904a, 1904b) est fournie par une réduction d'épaisseur par rapport à une partie adjacente de la membrane (110, 1310, 1510, 1710, 1910) et de la partie intérieure (107) ou de la partie extérieure (109).

3. La fermeture (100) de la revendication 1, dans laquelle la région annulaire structurellement affaiblie (804, 1304a, 1304b, 1504a, 1704, 1904a, 1904b) est fournie par un matériau ayant une rigidité inférieure par rapport à celle de la membrane (110), et de la partie intérieure (107) ou de la partie extérieure (109).

4. La fermeture (100) de la revendication 1, comprenant un couvercle protecteur (102) relié de manière amovible à une partie de corps (101) comprenant la partie externe (109) de la fermeture (100).

5. La fermeture (100) de la revendication 4, dans laquelle le couvercle protecteur (102) est relié à la partie de corps par une partie charnière (113) et/ou une ou plusieurs connexions cassantes (104) reliant le couvercle protecteur (102) à la partie de corps (101).

6. La fermeture (100) de la revendication 4 ou 5, dans laquelle la partie de corps (101) comprend une région filetée (708) conçue pour fixer la fermeture (100) à un récipient pour boisson.

7. Un récipient pour boisson comprenant un bouchon (100) selon l'une quelconque des revendications précédentes, contenant optionnellement une boisson.

8. Le récipient pour boisson selon la revendication 7, dans lequel le récipient est une bouteille.

9. Un procédé de fonctionnement d'une fermeture pour un récipient comprenant :

- fournir un récipient à boisson ayant une fermeture selon l'une quelconque des revendications 1 à 6 ;
- actionner la partie intérieure (107) par rapport à la partie extérieure (109) pour ouvrir ainsi une soupape comprenant l'élément d'étanchéité (704) et permettre le passage du fluide de l'intérieur du récipient pour boisson à travers un orifice de sortie (702), en passant par l'élément d'étanchéité (704) et hors de la fermeture (100) à travers une ouverture pour boire (108).

10. Le procédé selon la revendication 9, dans lequel la partie intérieure (107) est maintenue déplacée par rapport à la partie extérieure (109) par une pression d'aspiration différentielle à travers la membrane (110, 1310, 1510, 1710, 1910).
11. Le procédé selon la revendication 10, dans lequel lorsque la pression d'aspiration différentielle est éliminée, la partie intérieure (107) retourne à la première position en raison de la force de rappel fournie par la membrane (110, 1310, 1510, 1710, 1910).

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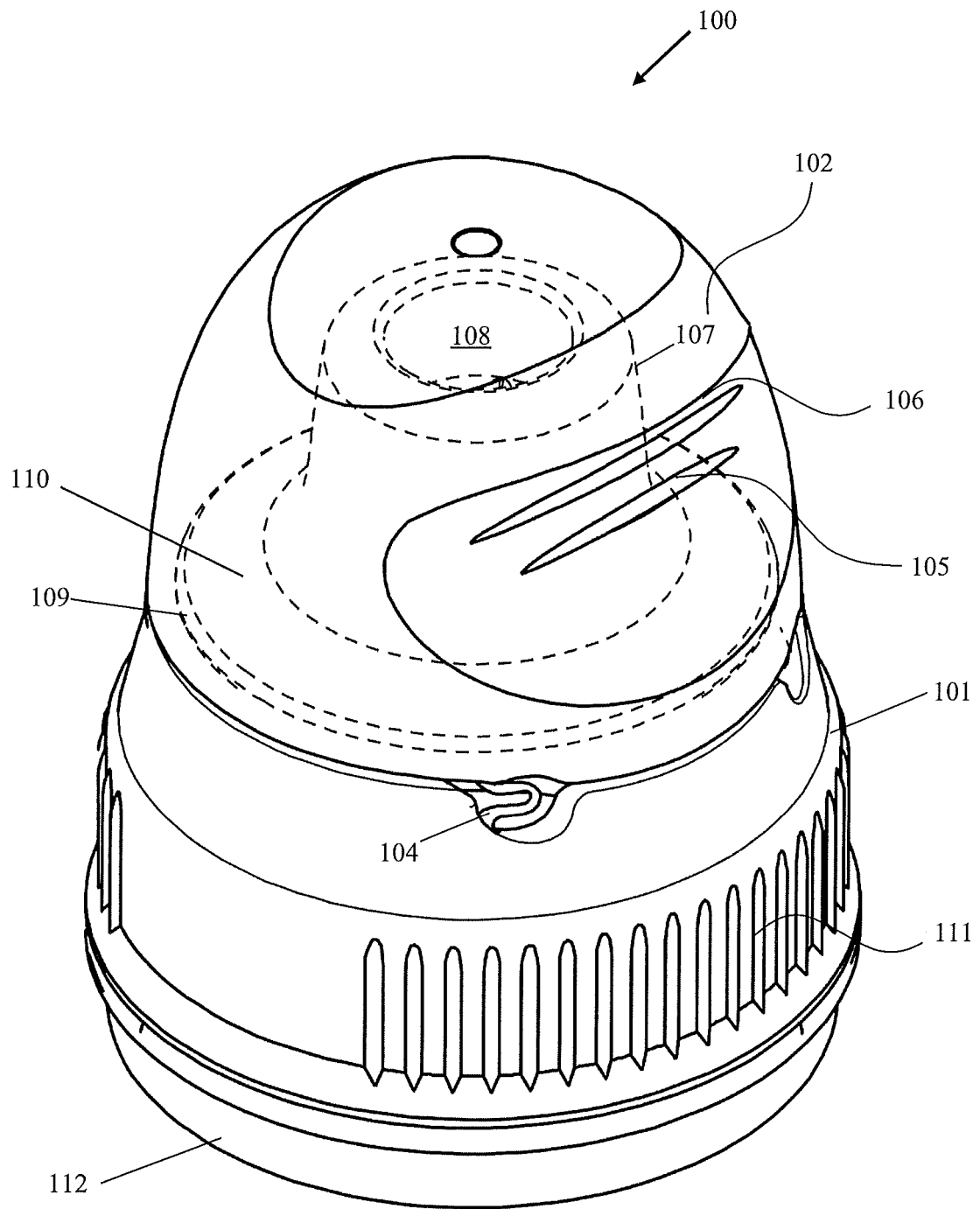


Fig. 1

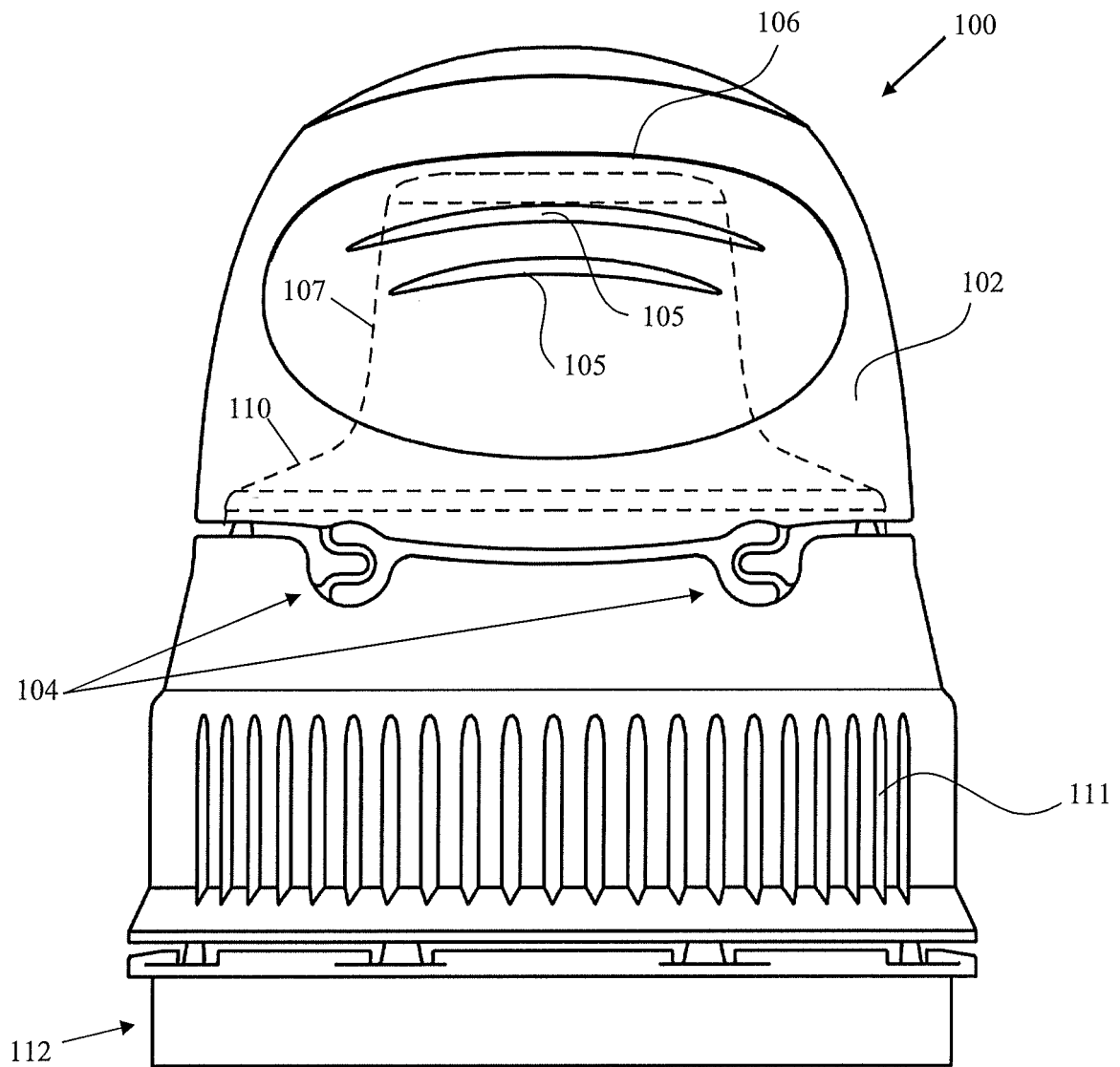


Fig. 2

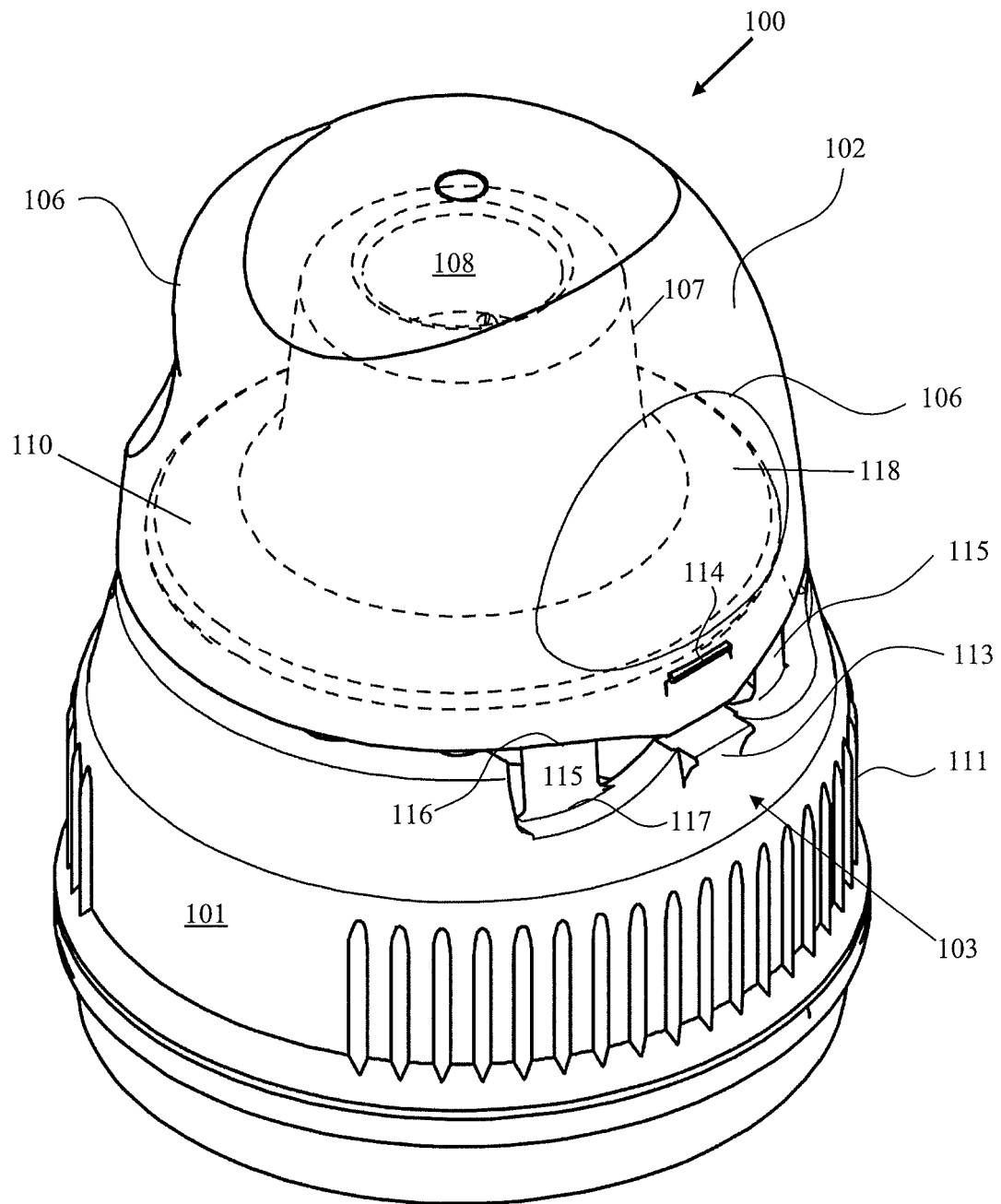


Fig. 3

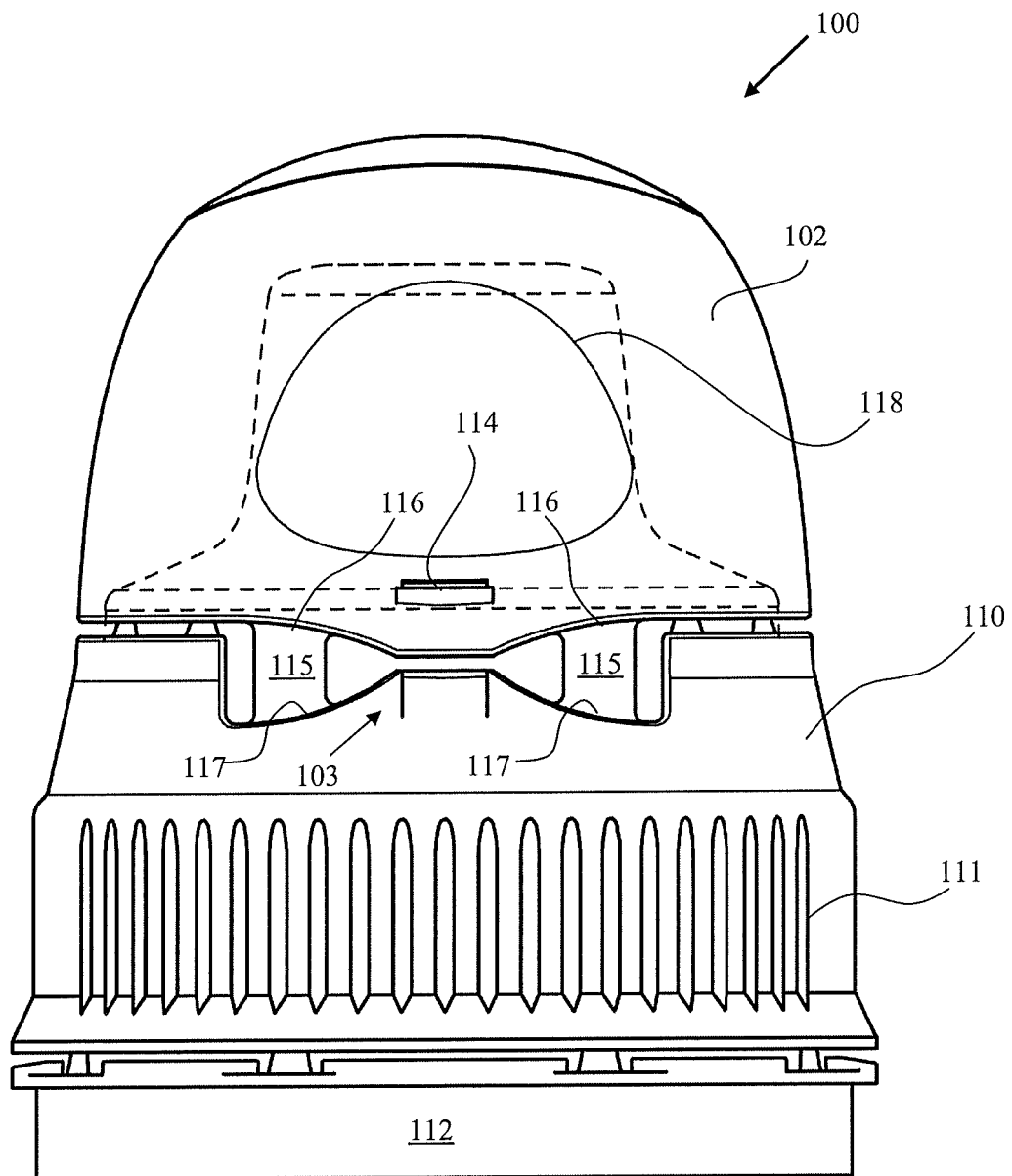


Fig. 4

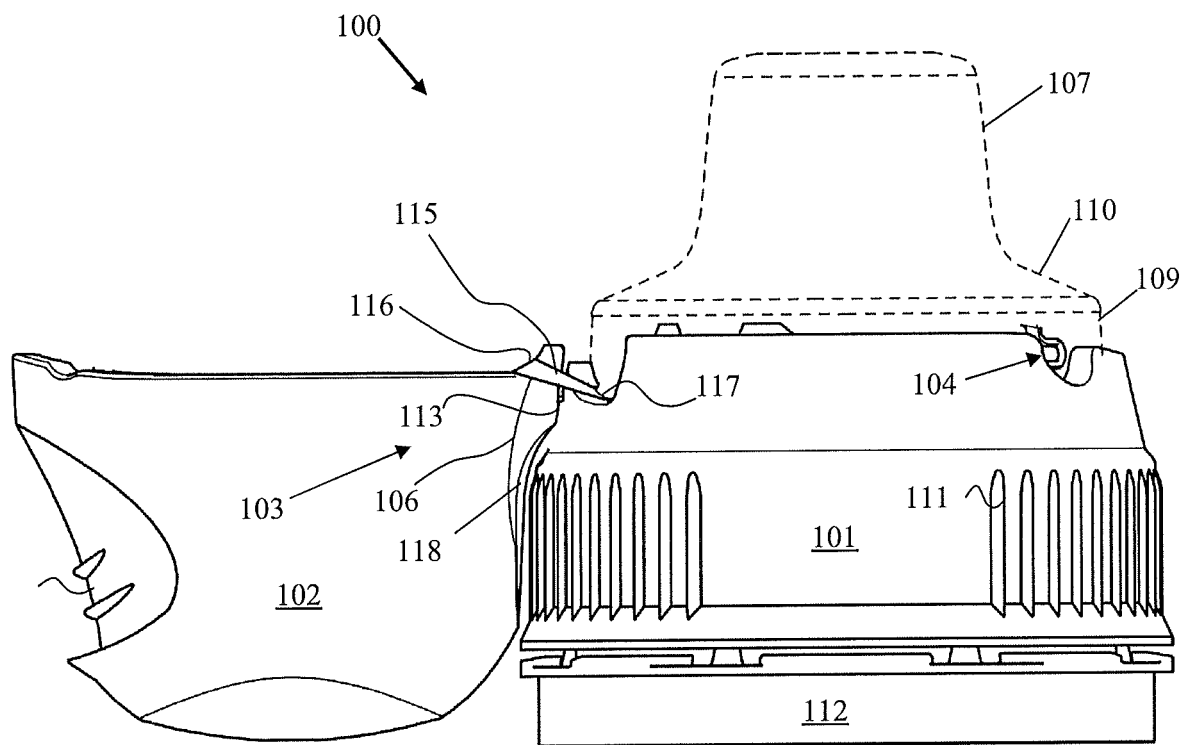


Fig. 5

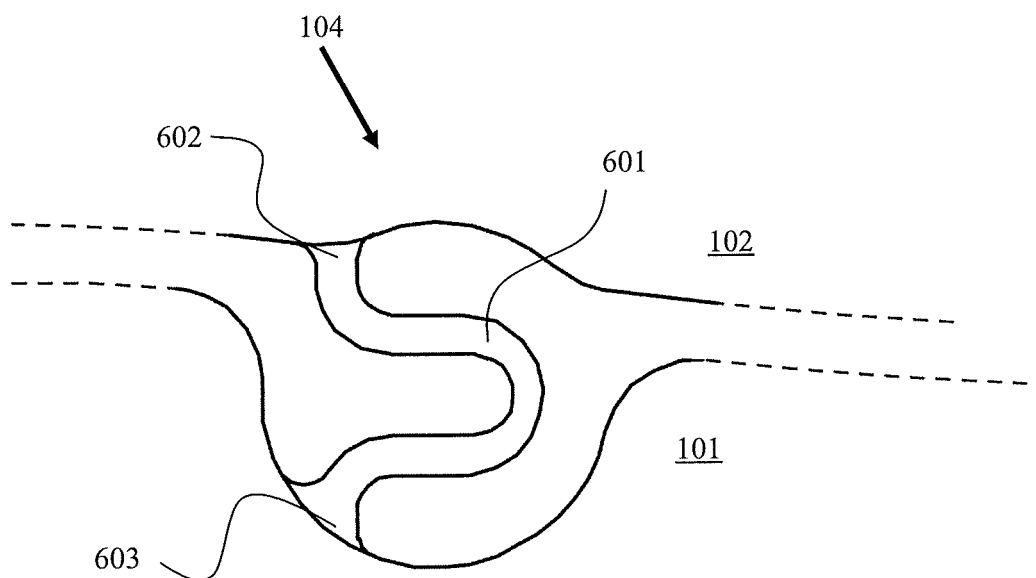


Fig. 6

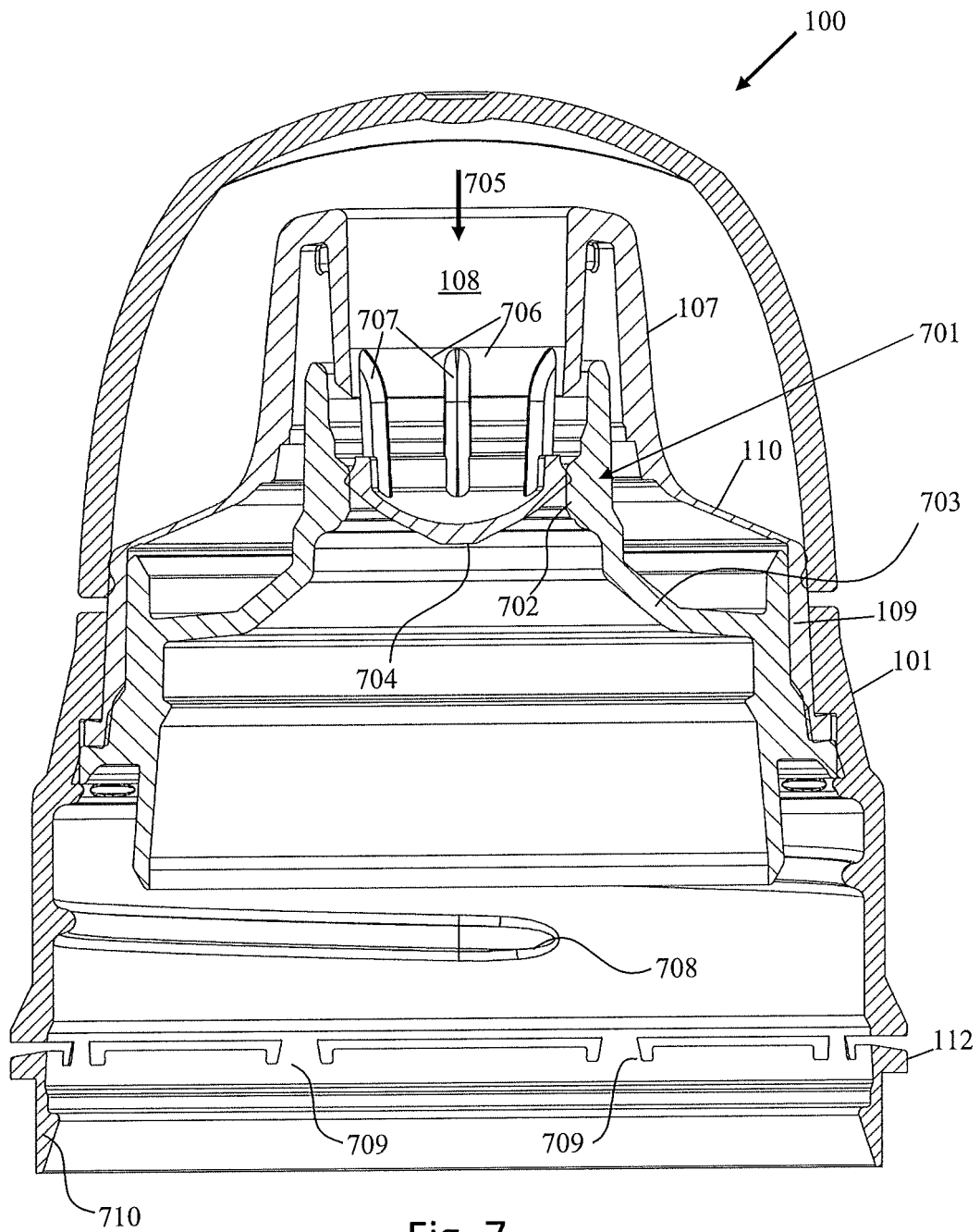


Fig. 7

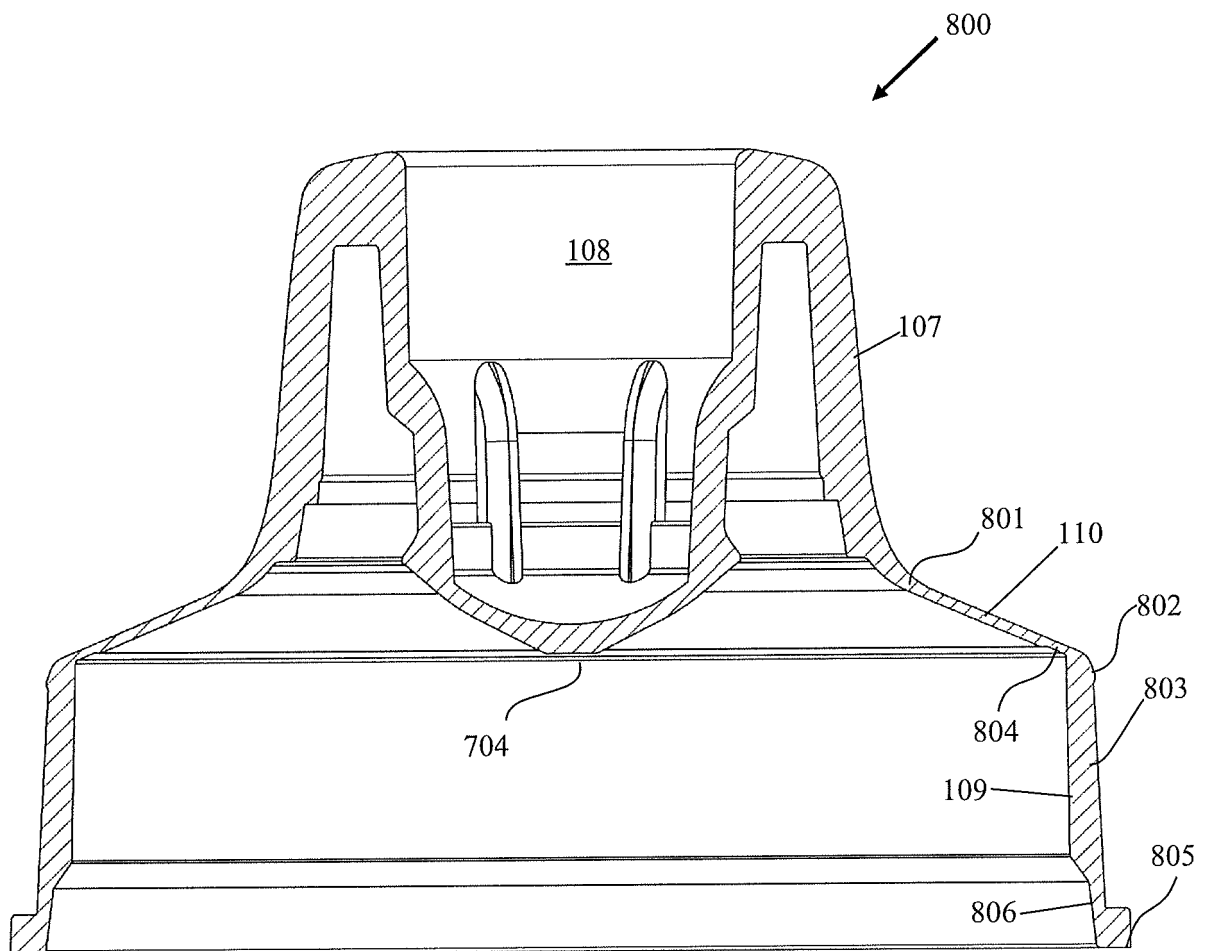


Fig. 8

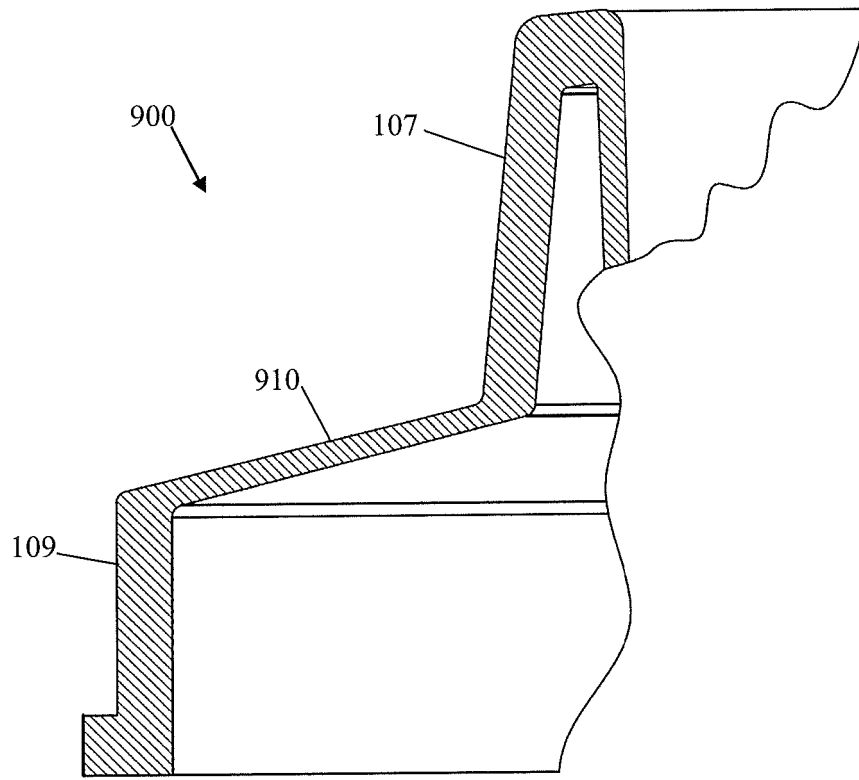


Fig. 9

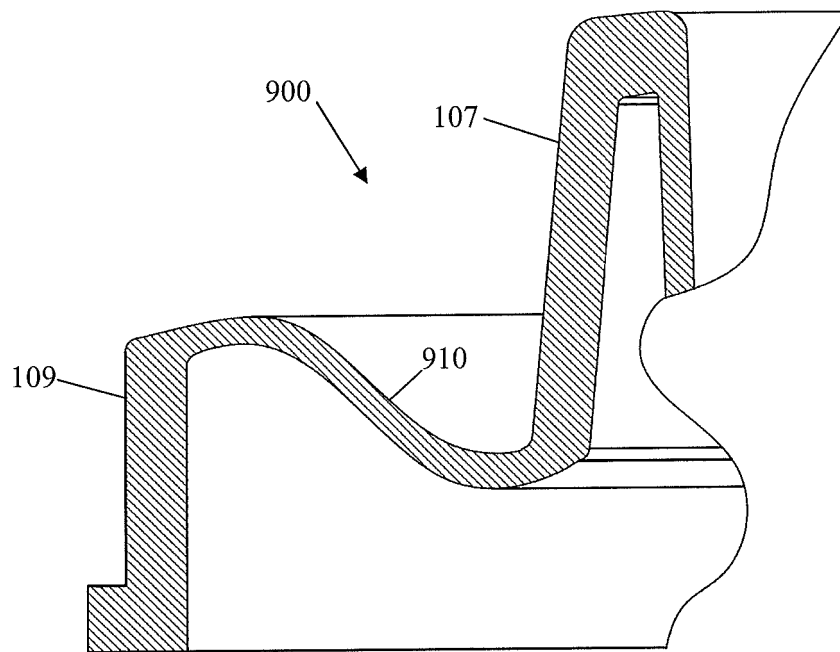


Fig. 10

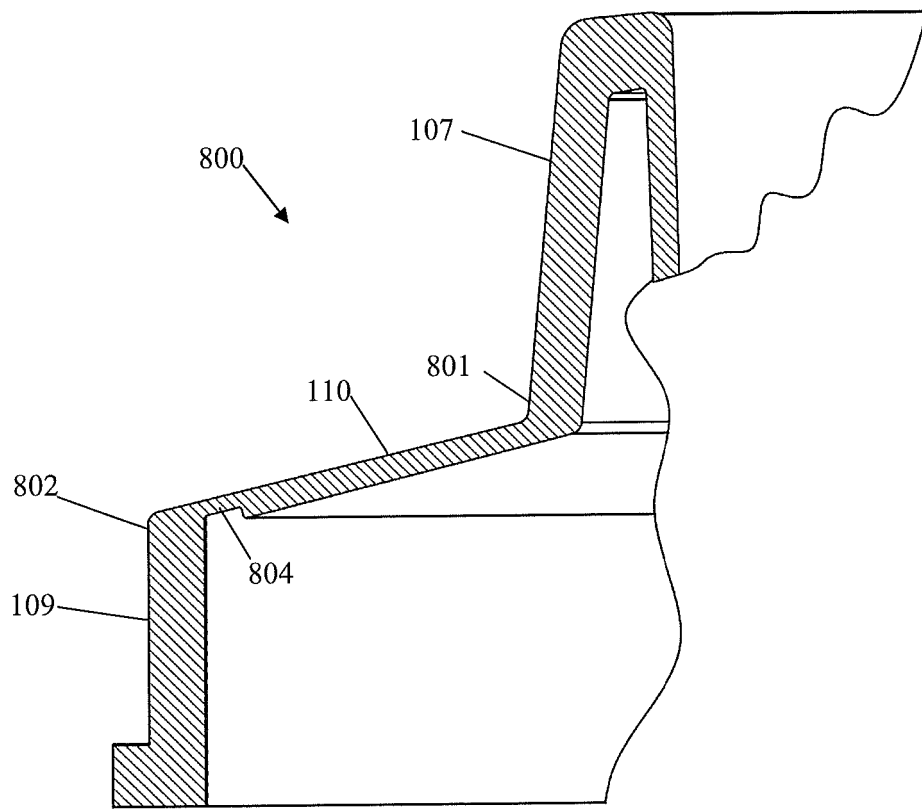


Fig. 11

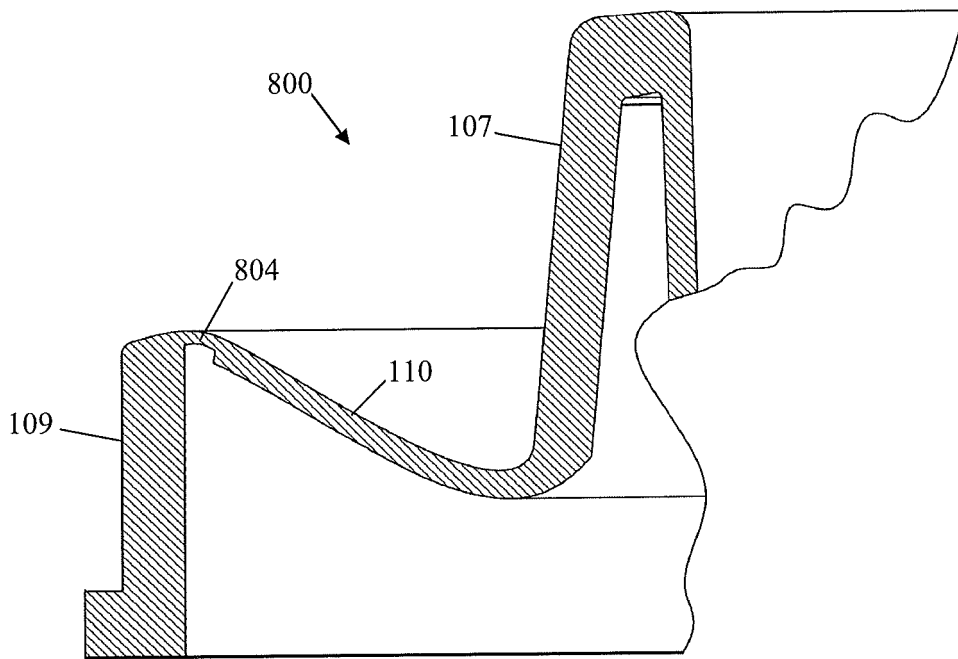


Fig. 12

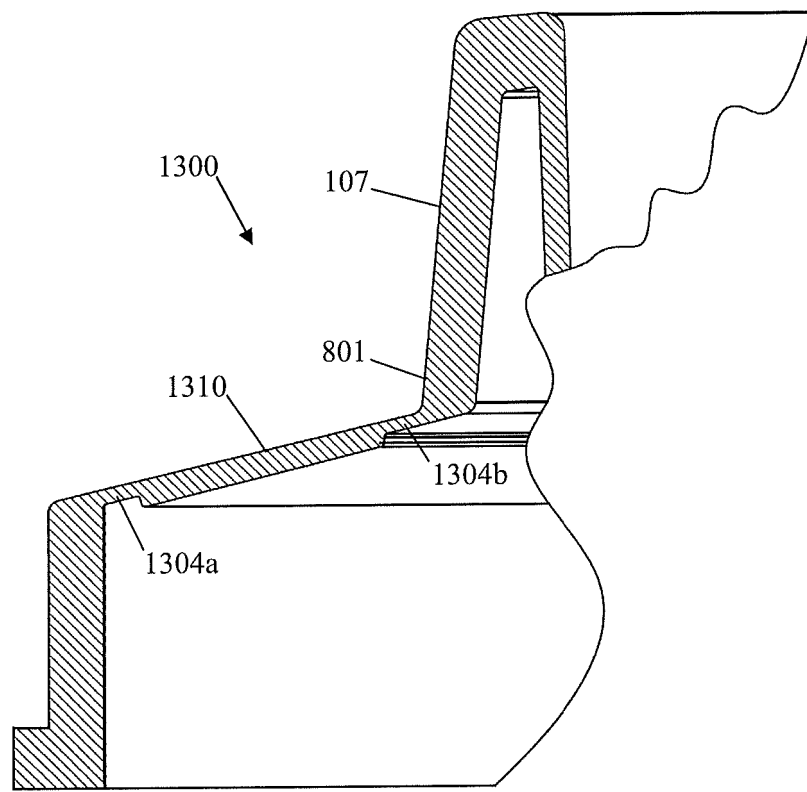


Fig. 13

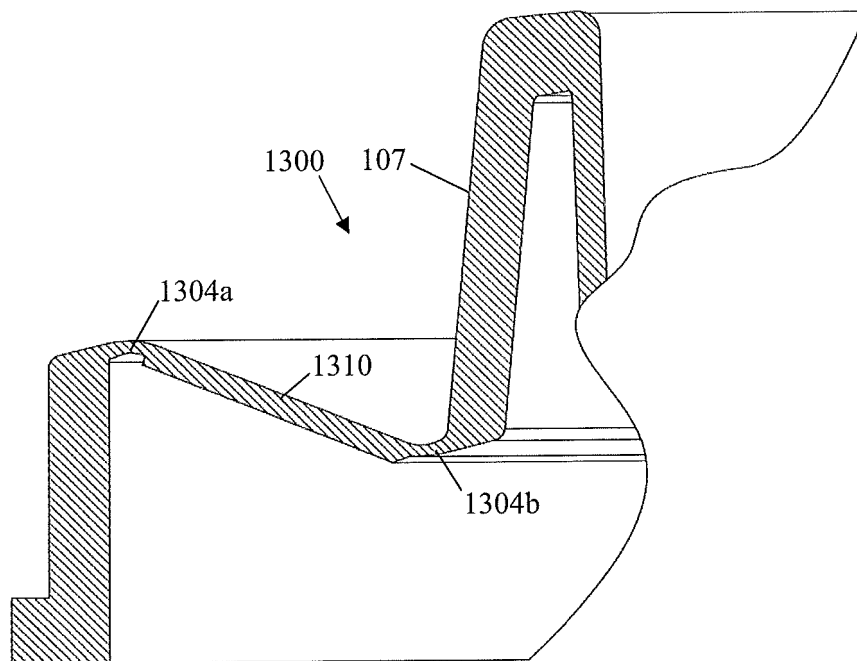


Fig. 14

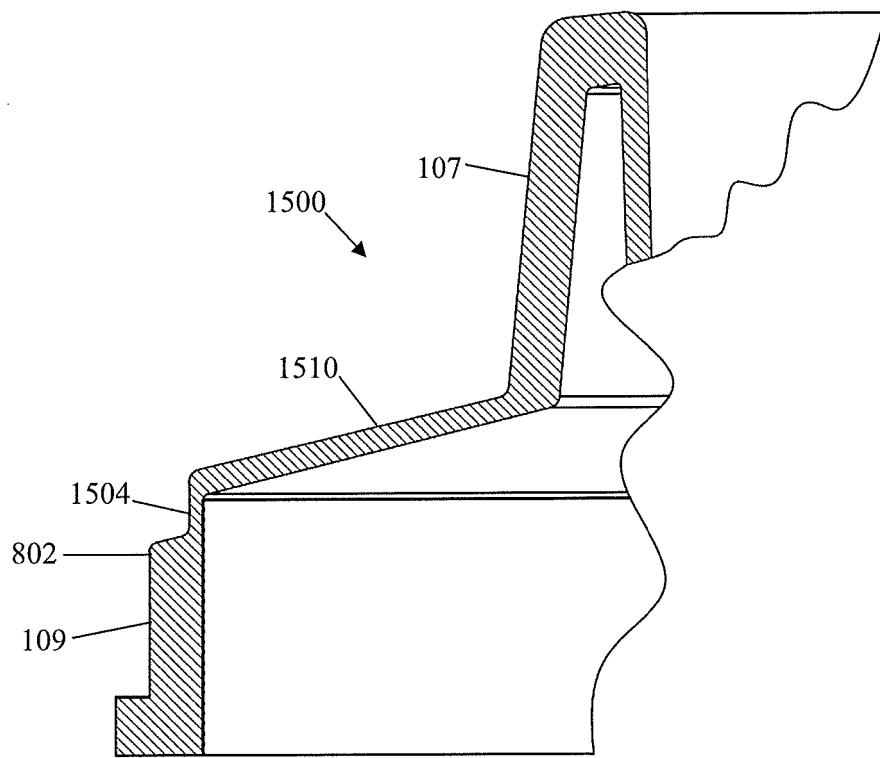


Fig. 15

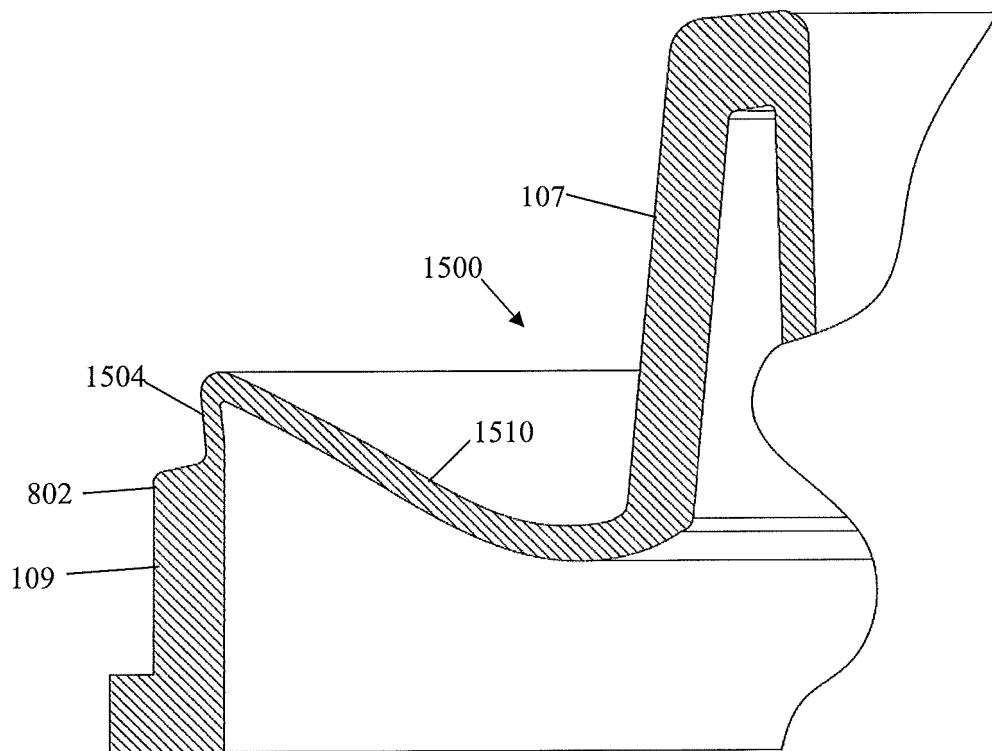


Fig. 16

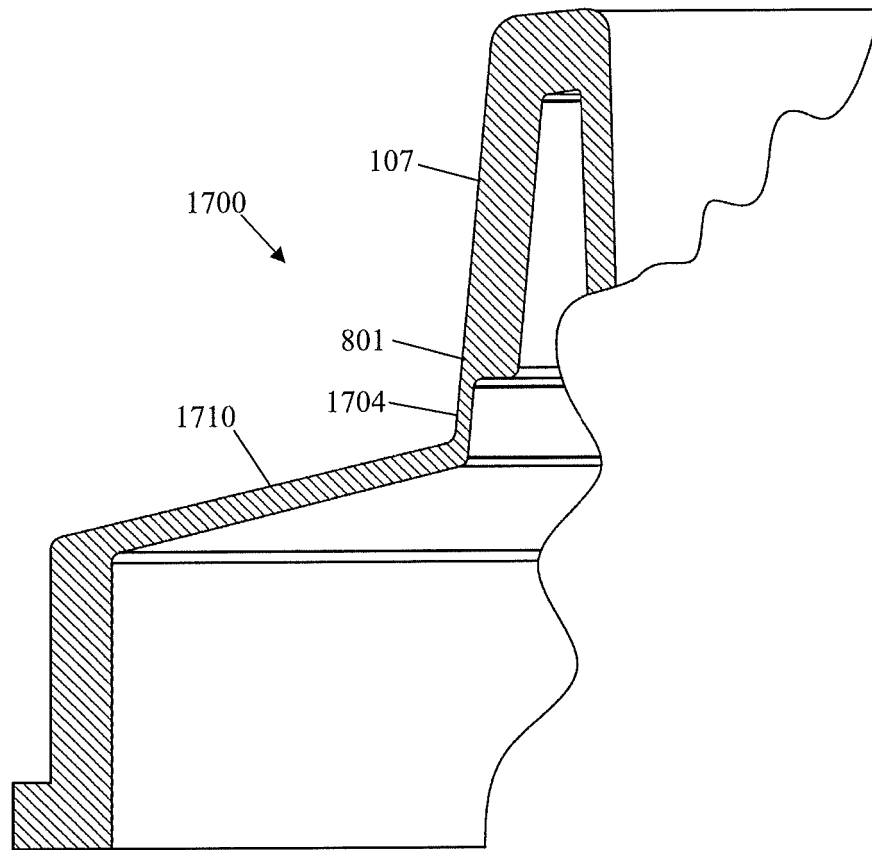


Fig. 17

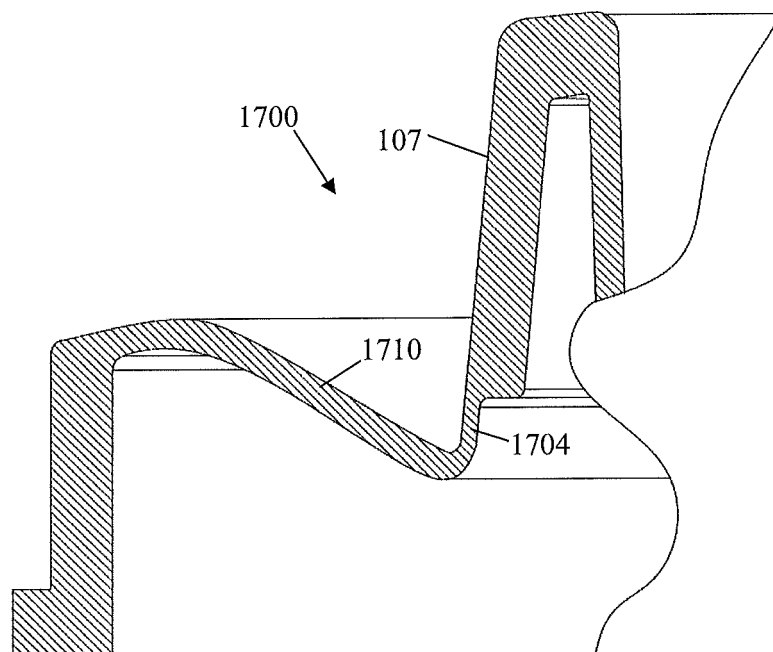


Fig. 18

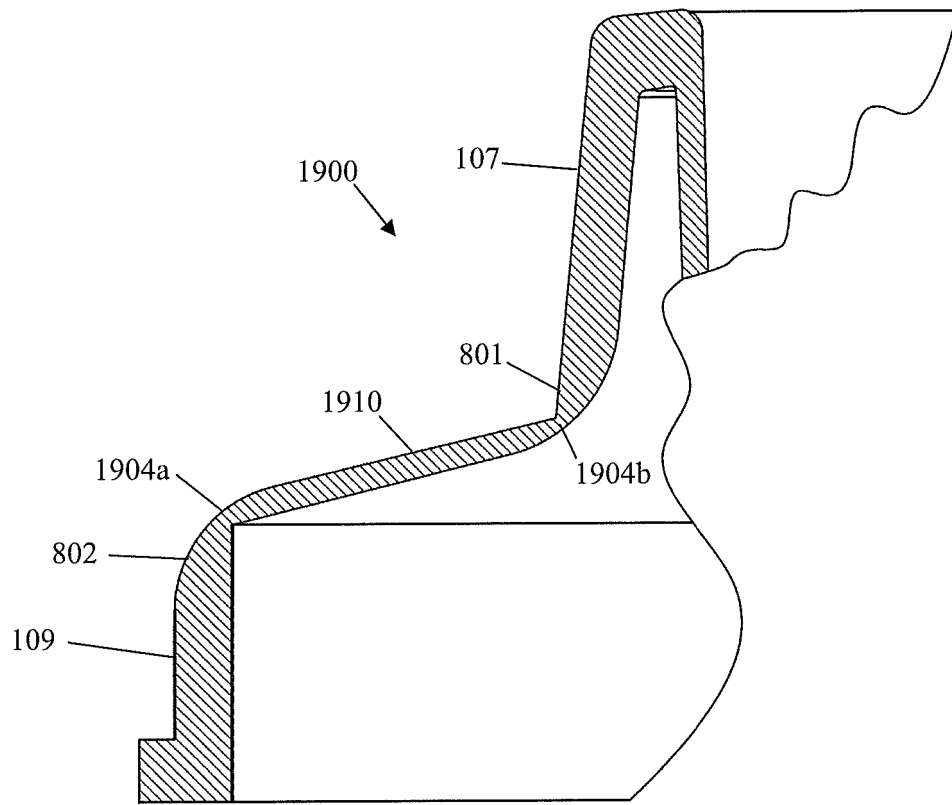


Fig. 19

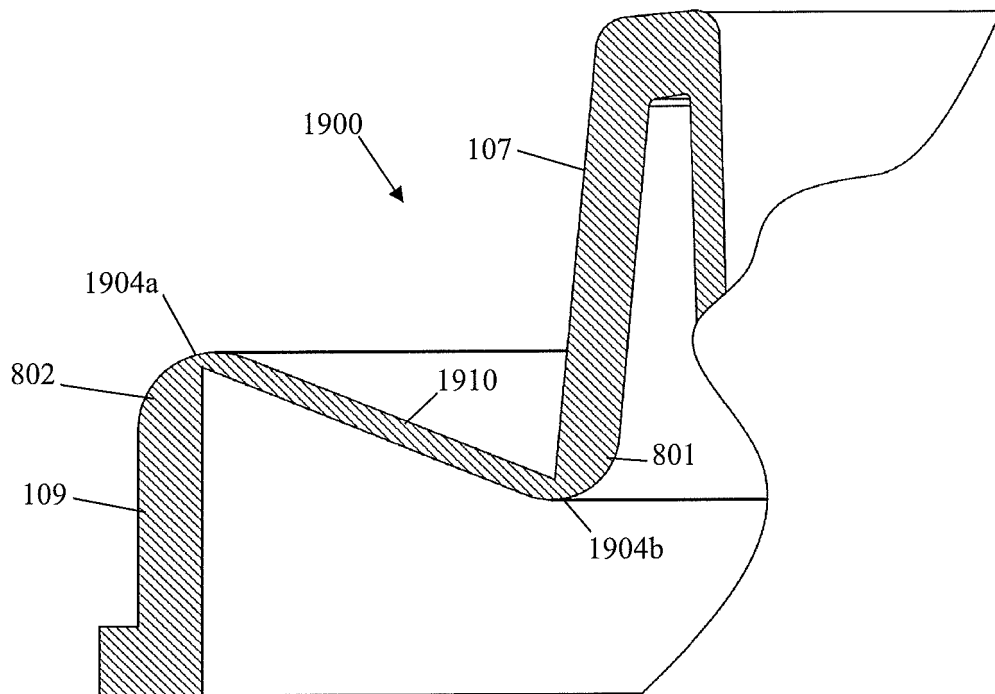


Fig. 20

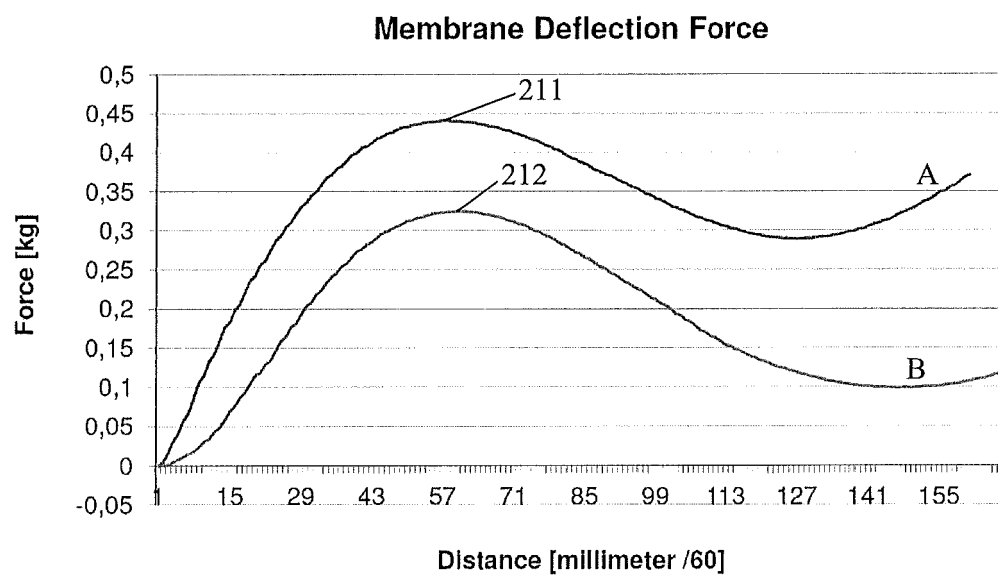


Fig. 21

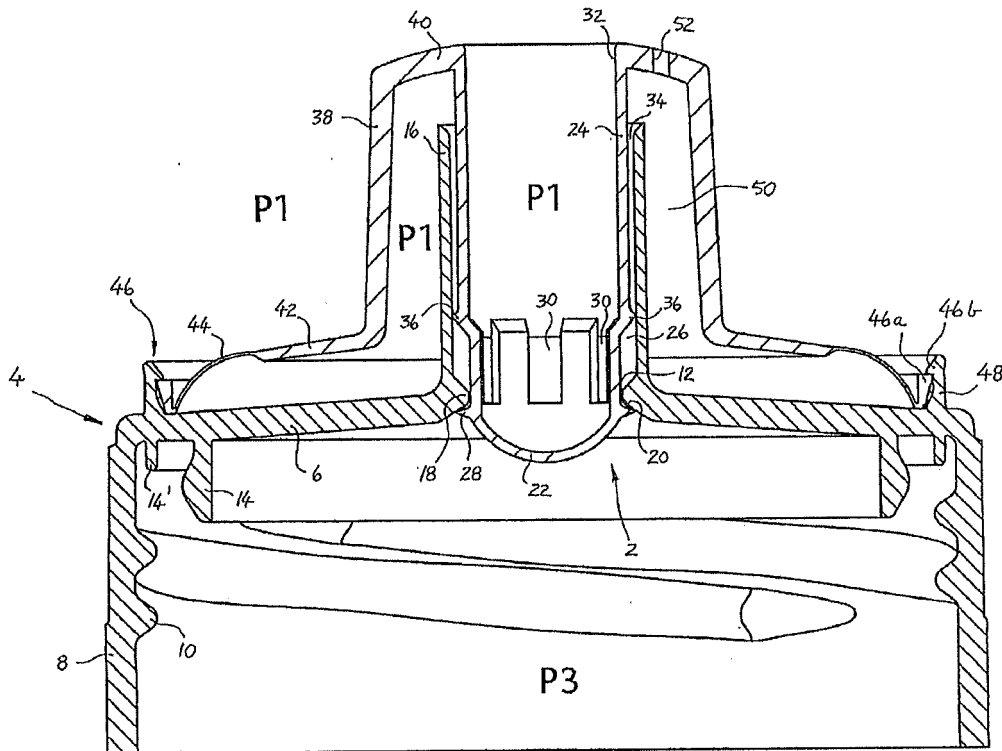


Fig. 22 – Prior art

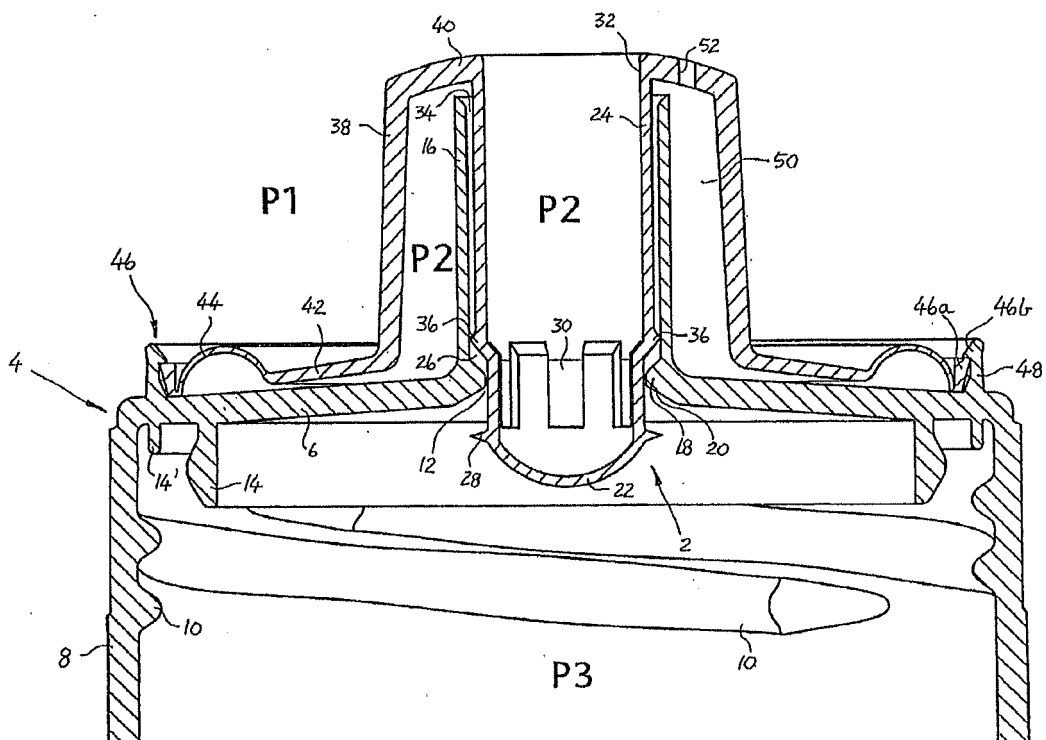


Fig. 23 – Prior art

REFERENCES CITED IN THE DESCRIPTION

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